A NEW AND UNUSUAL INSECT RECORD FOR NORTH AMERICA (DIPTERA—DEUTEROPHLEBIIDAE).

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Among the great variety of fascinating catches made by the writer in Yellowstone Park during the summer of 1921 an insect larva collected on July 30th occupied first place. The specimen was taken in a plankton net which had been anchored in the Yellowstone just above Cooke City bridge in the northeastern section of the park. The catch yielded a number of insect larvae, chiefly in fragments, rock diatoms, and some plankton carried by the river from Yellowstone Lake. Among this miscellany was a tiny larva, a trifle over a millimeter in length, possessing seven pairs of prolegs, long biramous antennae, and a distinct and free head.

Until recently this specimen constituted a puzzle to the writer. In fact, it is frankly admitted that at the time of its capture I was unable to recognize even the order to which the larva might belong. Biramous antennae are possessed by some Dipterous larvae, such as the subfamily Tanypinae of the Chironomidae. But the whole habitus of the specimen was so different from most of the Dipterous larvae known to me that I questioned its being a Dipteron. It seemed more like one of the Microtrichoptera which so often have fantastic and adventurous shapes. Further, the free head was unlike most Diptera.

Because of the smallness of the specimen, a little over 1 mm., and the difficulty of preserving it safely under field conditions, I decided to photograph it. This was accomplished by means of a field microscope and a long-bellowsed camera. Of half a dozen exposures that shown in the illustration was most successful. It is perhaps fortunate that the specimen was photographed, since a week later, when demonstrating it to Dr. Charles C. Adams (now Director of the N. Y. State Museum) and Prof. Alvin G. Whitney, of Syracuse University, and Dr. Gilbert M. Smith, of Stanford University, the head was badly crushed. Still, the photograph shows all the features needed for exact identification.

The head is separate and free, the biramous antennae longer than the head, reminding one of those of Cladoceran Crustacea. Most pronounced is the slightly flattened body showing the digestive tract, and the seven pairs of pseudo-legs, broadly attached to

the abdominal segments, and each with a terminal pad and several circlets of claws. The shape of the feet indicated that these serve in two ways: (a) the claws acting directly as holdfasts, and (b) the soft pads serving as suckers by appression, much like the tube-feet of star-fish, sea-urchins, and other Echinoderms. Here evidently was a highly specialized means of clinging to rocks in swift currents, affording secure fasthold together with a certain degree of mobility.

With this in mind the writer on successive days, following July 30, examined the rocks in the rapids of the Yellowstone River for similar specimens. Although adult Blepharoceridae were abundant, the larvae were always too far out in the rapids to be reached. For some reason it seemed that if found at all they should occur with the Blepharoceridae. Similar searches were tried in Lamar River and Tower Creek, where the shallower water and less powerful current permitted examination of rocks carrying Blepharoceridae larvae and pupae. In all cases search was resultless. From the small size of the larva it was evident that any specimens might readily pass through the meshes of an ordinary water net. Scrapings from rocks, the loosened scum being caught in a very fine-meshed plankton net, were also tried. But no second specimen was found.

During the following winter all available literature on aquatics was ransacked for a possible identification—without result. Later some prints were sent to Dr. O. A. Johannsen, of Cornell University. Dr. Johannsen was immediately interested and also much puzzled, but wrote that he thought it most likely a Dipterous larva. He further submitted the prints to Dr. Böving at Washington. The latter gave his opinion that it might be some beetle larva.

On December 4, 1924, Dr. Johannsen sent me a note calling attention to a recent paper by Miss Pulikowsky in the Transaction of the Entomological Society of London. Having just been released from the hospital after a severe operation and busy with teaching and later with moving and establishing myself in a new position the matter perforce had to rest for the time. But recent opportunity to examine Miss Pulikowsky's paper and comparison with the photographs of the Yellowstone River specimen prompts the publication of this record.

There can be no doubt of the identity of the larvae described by her with that from Yellowstone Park. Legs, head, mouthparts, antennae, are all as described and figured. There is a superficial

difference: As appears from the photo the head of the Yellowstone specimen is far larger in proportion to the body than shown in the sketches of the Siberian specimen. The same applies to the antennae, especially to the smaller ramus, the prolegs and the anal cerci. All this is secondary, however, and may be explained on the basis that the Yellowstone specimen is immature and only a trifle over a millimeter in length while Miss P.'s figures are taken from fully grown specimens about 4 mm. long. And it is a well-known fact that in younger larvae the externals and particularly the head and appendages are disproportionately larger than in full-grown specimens.

But this identity establishes the presence of a very remarkable family of Diptera in North America, namely, the Deuterophlebiidae. The type species of this enigmatic family was first described by Edwards in 1922 from two males taken at Srinagar, Kashmir, India, near a mountain stream at an elevation of 11–12,000 feet. Miss Pulikowsky's specimens were all larvae and pupae, collected from a stream in the Altai Mts., in the Russian province of Semipalatinsk, Eastern Siberia, at an altitude of about 3,500 feet. The dates of collection are given by her as July 23 to 30. These specimens were sent to her in larval and pupal form; from this lot she succeeded in rearing one female. Eventually she published descriptions of larvae, pupae, and female adult, together with detailed anatomical data.

It is unknown if the Yellowstone species is identical with the Asiatic forms. For positive determination the adults would be needed. Dr. Johannsen, in a recent letter, says this of the original specimens from Kashmir: " The fly as described is a most peculiar one and reminds one superficially of a small, very delicately veined mayfly. Structurally, however, it is undoubtedly a close relative of the *Blepharoceridae*."

The general facts pertaining to the larva, pupa, and adult are summarized by Miss Pulikowsky in the following words (p. 60):

" As to the proximity which Mr. Edwards supposes as existing between Deuterophlebiidae and Blepharoceridae I can say but as follows: If we compare the larvae of *Deuterophlebia* with the Blepharocerid larva a considerable difference can be remarked. The head and the thoracal segments are not united to a cephalothorax; there are no ventral suckers. The larvae are supplied with large leg-like abdominal appendages. The mouthparts and antennae are quite different structures in both forms. The simi-

larity of the pupae can be treated as a convergence, provoked by identical physical conditions of existence. Indeed, the Psychodid pupa of *Maurina* (Fritz Müller) living together with the larva of *Curupira* in streams takes the shape of a Blepharocerid pupa. The ' secondary venation ' produced by the folding of the imaginal wing within the pupal case is, too, a remarkable adaptation of the species of this family, as in the Blepharoceridae and Simulidae. Other imaginal characters, as the absence of ocelli and mouthparts, six-jointed antennae, sharply differentiate the new family from Blepharoceridae. So the family Deuterophlebiidae may be referred to the suborder *Orthorapha Nematocera,* where it occupies an isolated position."

In going over my collections and notes I find some additional items which may be relevant. During the afternoon of July 10 I collected what I then called " very small Blepharocerid pupae " from a sluice dam in Lost Creek, just above Camp Roosevelt in Yellowstone Park. " Where the water beats hardest, the pupae occur. No larvae noticed, no adults seen " (notes of July 10). A *Bibiocephala comstocki* adult was taken at the same point. Although it was very difficult to gather the specimens through the splashing current, fragments of seven or eight pupae were gathered.

Another very small pupa, scarcely 4 mm. in length, and probably belonging to *Deuterophlebia,* was taken from Tower Creek on August 2. Although the pupae of the Blepharoceridae taken in Yellowstone Park (*Bibiocephala grandis* and *comstocki*) vary somewhat in size, their average is more than double that of these smaller pupae taken, namely, from eight to eleven millimeters. The pupae from Lost Creek and Tower Creek are a scant 4 mm. or less in length. If they belong to *Deuterophlebia,* three records would be established for Yellowstone Park:

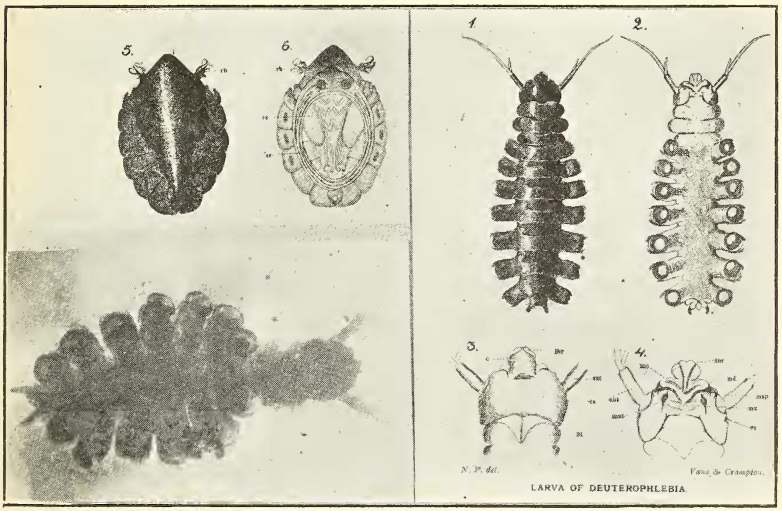
July 10. Lost Creek, above Camp Roosevelt. Seven to eight pupae. Elevation 6,300 ft.

July 30. Yellowstone River, at Cooke City bridge. One immature larva. Elevation 5,900 ft.

August 2. Tower Creek, about four miles above Tower Falls. One pupa and fragment of another. Elevation 6,700 ft.

The Yellowstone Park record establishes a third locality for this unique family of Diptera. The altitudes, though widely separated, permit a conjecture as to the possible distribution of the genus. The Kashmir record in India noted 11–12,000 feet, the

Altai Mountain record listed 3,500 feet, while the Yellowstone Park records vary from 5,900–6,700 feet. The farther north, the lower the altitude—a fact which accords with other data as regards distribution of animals and plants. From the altitudes noted I would judge that the species belongs to the subarctic life zone or at least to the Canadian zone of distribution. Dr. Charles C. Adams, who viewed the specimen in Yellowstone Park, makes the following comment: "That this insect is found in Asia and Western United States, is paralleled by many animals—the Dipper or Ousel, the butterfly Parnassius, etc."



Figs. 1–6 from Miss Pulikowsky's illustrations. 1–4, larva of Deuterophlebia; 5–6, pupa. Last figure from Yellowstone Park specimen.

I wish to express my sincere appreciation to Dr. A. O. Johannsen for his aid and interest in bringing about the determination of the Yellowstone specimen.

Edwards, F. W. *Deuterophlebia mirabilis,* a remarkable Dipterous insect from Kashmir. Ann. & Mag. Nat. Hist., IX, p. 339 1922.

Pulikowsky, N. Metamorphosis of *Deuterophlebia* sp. (Diptera-Deuterophlebiidae Edw.). Trans. Ent. Soc. London, parts i and ii for August 30, 1924, pp. 25–63, pls. IV–VI and five text figures.